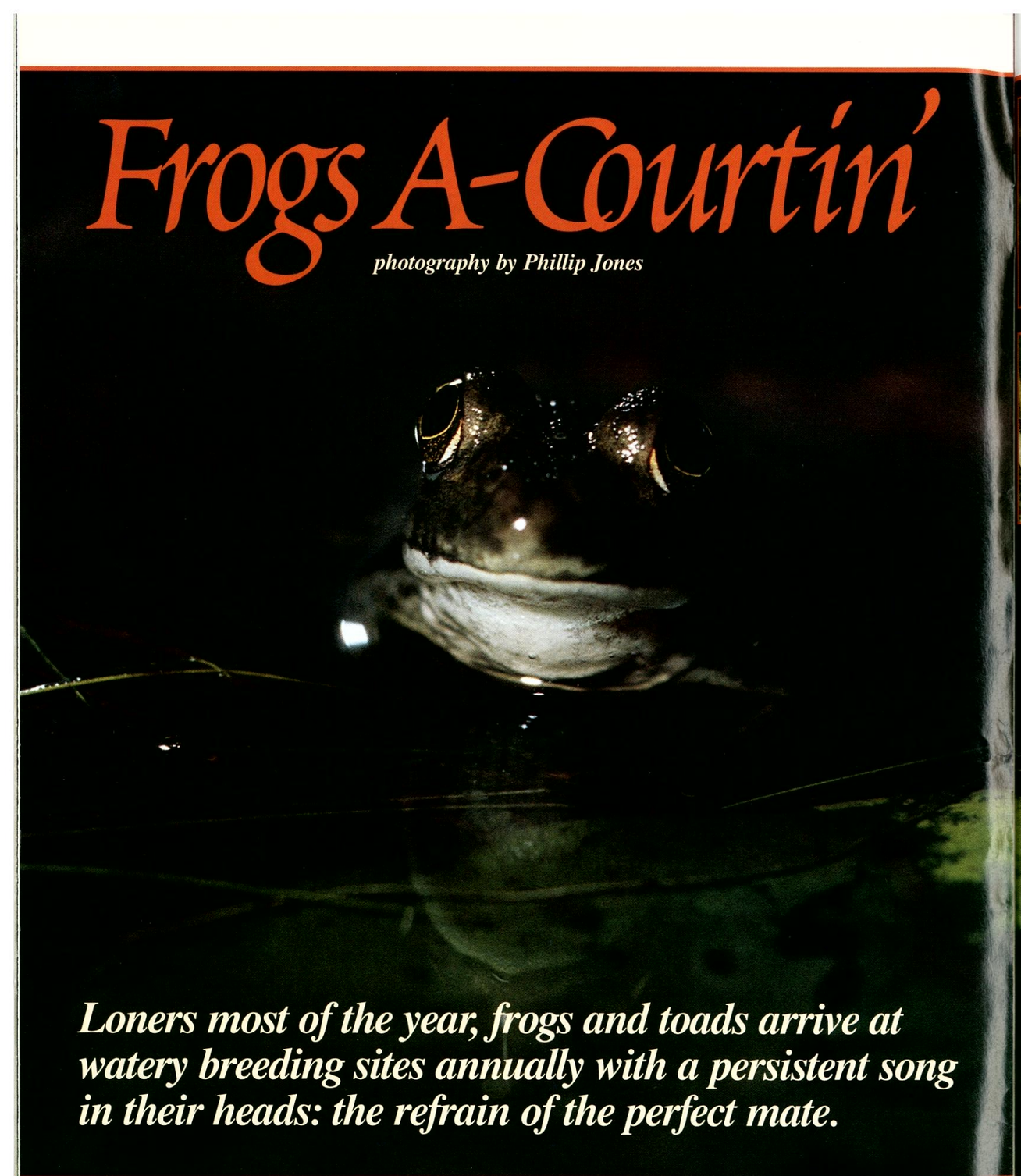
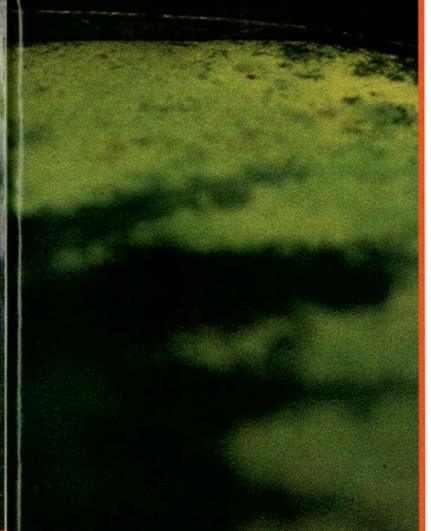
Frogs A-Courtin'

photography by Phillip Jones



Loners most of the year, frogs and toads arrive at watery breeding sites annually with a persistent song in their heads: the refrain of the perfect mate.

Perched atop a lily pad in deep water, a lone bronze frog prepares to call a mate, while in the shallows, a male Southern toad (inset, top) calls, using his inflated vocal sac to amplify the sound. A pair of Southern toads (inset, bottom), in amplexus, prepare to deposit their eggs.



by Steve Bennett

AS THE SUN DISAPPEARS, cloaked by cypress and gum trees, the small pond lies still and quiet . . . but only for a moment. Under the veil of darkness primitive creatures begin to stir . . . and croak . . . and trill . . . and grunt. So begins an ancient ritual that has filled many a swamp, pond or wetland with the music of frog romance for countless generations.

Frogs and toads (toads are really just a type of frog) live solitary lives as adults, whether it's along the edge of a pond or stream or in a forest under a fallen log. They are not social creatures by nature, except during the time of year they are drawn together to mate and reproduce their species.

Frogs, like all other animals, face the age-old problem of finding a suitable mate. They must accomplish this task practically on a moment's notice and with little time to spare. All of South Carolina's native frog species lay eggs in water; therefore rainfall plays a key role in triggering the froggy social season. Rain, whether the first warm rains of late winter or a summer deluge, will summon some species of frog to a local breeding site . . . be it pond, marsh or swamp. Once there, the trick is finding the right frog among dozens, sometimes hundreds, to choose from.

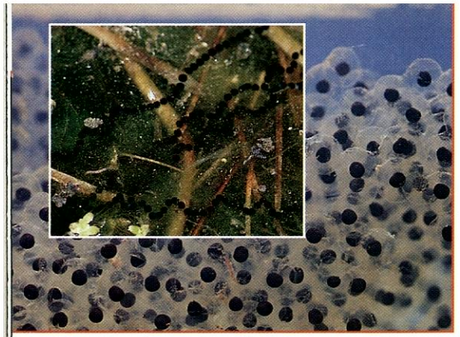
Frogs, like some other animals, have come to rely on sound to play a key role in the mating ritual. Male frogs possess a fine set of vocal cords and a vocal sac with which they can produce a variety of sounds and calls. Frogs, in fact, were the first animals to develop vocal sounds. Each species of frog produces a distinct "call," recognized by females of this species and ignored by females of other species.

Back at the pond a slow, melodic trill arises from the tall grass near the pond's edge. Soon the chorus of trilling toads grows in its ranks. A dozen or more males may join the chorus. They will compete for the attention of females, lured to the pond by the courting males.

These are Southern toads, a species common throughout much of South Carolina. They are early spring breeders, waiting until the air and the water warm slightly to gather at a breeding pond. As the males trill away, females begin arriving to search for the "right guy." Females may be attracted to males based on the strength of the call or some other tonal characteristics; that remains somewhat of a mystery.

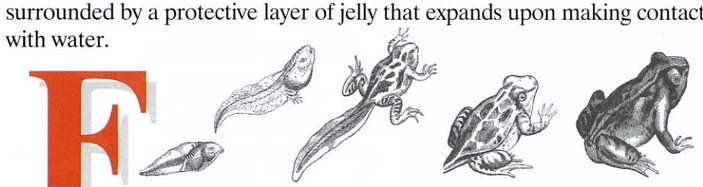
We do know that once a female has approached a male he doesn't waste a moment. The male suitor clasps the female with his front legs so as to align his cloaca with hers. (Amphibians, reptiles and birds all possess a cloaca, from the Greek word *cloacum,* meaning sewer. This is the common exit for the excretory and reproductive systems.) This close alignment is crucial, as most frogs use external fertilization for their eggs. The proper name for this frog embrace is *amplexus*.

The female toad releases long strands of eggs, like tiny, dark pearls, into shallow water. The male immediately fertilizes the eggs by releasing sperm, just as they emerge from the female's body. Once the eggs are fertilized and in contact with water, a jelly-like membrane that surrounds each individual egg swells. The membrane provides some protection from water-borne mold and other microorganisms and from physical damage caused by movement. The egg jelly of toads also contains distasteful substances that keep fish and other aquatic animals from dining on them.



Across the pond, from deeper water, a new voice joins the amphibian symphony, only this one is not very symphonic—it's more like the Grand Ol' Opry. At first the new frog sounds like a banjo string being plucked. In fact some folks call it the banjo frog. Actually the bronze frog, a southern relative of the green frog, it makes a single, twangy *c'tung* while floating in the pond. This call is repeated every so often until a female bronze swims his way.

Bronze frogs, like Southern toads, use amplexus to ensure their eggs are fertilized. Unlike toads, bronze frogs accomplish this while floating in water. Another difference between the two species is the egg mass they produce. Bronze frog females lay their eggs in large, globular masses, unlike the strings of eggs deposited by Southern toads. Their eggs, like those of toads, are surrounded by a protective layer of jelly that expands upon making contact with water.



FROG AND TOAD EGGS are simple structures. Each individual egg is a small sphere of clear jelly with a tiny black dot in the center. This dot is the embryo, the beginning of a frog or toad. Sharing the center of the egg with the embryo is a small supply of yolk, which provides nourishment for the developing embryo until it becomes a tadpole capable of feeding itself.

Development occurs at different rates for different species of frogs and toads. Water temperature affects development—eggs in warmer water tend to develop faster. The life history of a species also plays a role in this process. Spadefoot toads, a terrestrial, burrowing frog species, are explosive breeders. They wait for big rainfall events to fill isolated ponds, where hundreds of them will mate and lay eggs in the span of two to three days. The isolated ponds they use for breeding don't last long; consequently spadefoot toads can go from egg to newly metamorphosed toadlet in as little as two weeks. Bullfrogs, on the other hand, tend to breed in permanent bodies of water, and they can remain in the tadpole stage for up to a year, possibly longer in northern climates.

Almost a week has passed since our Southern toad and bronze frog females have deposited their eggs in the pond. The black dot in the center of each egg has become more comma-shaped over the past few days and external gills are now present. Soon both tadpoles will emerge from the eggs and begin life as free-swimming, self-feeding individuals.

Upon hatching, both types of tadpoles retain their external gills, and they still look more like a comma than a tadpole. They use developing mouthparts as though they were hands, at first to cling to the egg, then to cling to vegetation or detritus as they continue to grow. In a few days a flap of skin called an operculum grows over the external gills and they are no longer visible. At this point our tadpoles more closely resemble the "classic" image of tadpoles or pollywogs. Now, they are capable of swimming and, more importantly, they are ready to eat.

In the shallow water near the pond's edge, small, dark toad tadpoles patrol among the grasses and sedges. In deeper water the bronze frog tadpoles, larger and greenish in color, swim among taller shrubs. Both tadpoles have horny, rasp-like mouthparts that act somewhat like teeth. They use these "teeth" to scrape algae from leaves, grasses and stems.

All of South Carolina's tadpoles are vegetarians, and all of the frogs and toads they become are carnivores. One obvious clue to the tadpole's vegetarian lifestyle is the length of its intestines. If you have ever looked at a tadpole's belly, you've seen a spiral intestine that practically fills the tadpole's entire body. Intestine length is important to animals that must digest vegetable material. In other words, it takes a lot of guts to extract the nutrients from plants.

One of the most obvious characteristics of the tadpole is its tail. Typically long and muscular, this is the tadpole's only means of propulsion. Tadpoles tend to hide under leaves, grasses and other debris where potential predators can't locate them, then use their strong tails to propel them in search of food.

Avoiding predators is a major issue with tadpoles, and they have developed a number of ways to accomplish this. Many tadpoles hide from predators, but some do not. Some tadpoles, like those of our friend the toad, contain distasteful compounds that make them less than desirable as food. One of my favorite tadpoles, that of the cricket frog, has a black tail tip. Some scientists believe that this tail tip would distract potential predators. If a predator finds a cricket frog tadpole, the tadpole swims quickly away, with its black tail tip flapping, and the predator grabs the tail tip. The tadpole, alive but missing a portion of its tail, lives for another day.

River frog tadpoles employ an unusual predator avoidance technique, at least among South Carolina tadpoles—schooling. These large relatives of the bullfrog live along major river systems and breed in oxbow lakes and ponds near the rivers. These lakes and ponds are filled with predatory fish. Schooling, where hundreds, perhaps thousands of river frog tadpoles swim in tight formation, may confuse predators and protect individual animals that are in the center of the school.

Swimming and eating, eating and swimming . . . aside from the occasional predator-avoiding, this pretty much sums up the life of a tadpole. Of course there is the issue of becoming a frog—metamorphosis—the change of life. A few days to a few weeks after hatching (depending on the species and water temperature), a tadpole will start to grow hind legs. These appendages appear right where the tail and the tadpole body meet. After the hind legs develop fully the front legs begin to appear, and the tadpole body starts to look more and more frog-like.

Once both sets of limbs are well developed the tail begins to disappear. Young froglets may leave the water with a tiny portion of their tails intact, but this will be completely absorbed in a few days. The froglets, newly metamorphosed frogs, will typically stay at the edge of the pond for a while. They are waiting for rain before making their journey into new habitat. It is likely that some of the new frogs and toads will stay close to their "home" pond, while others will set off to find a new home.

Frogs and toads are fascinating and beneficial components of South Carolina's environment. They are voracious insect eaters, and many are strikingly beautiful. Worldwide frogs and toads are experiencing localized population declines, caused in some measure by pollution and possibly by climate change. Our amphibian neighbors may be telling us something important about the world we all live in.

If we listen closely, perhaps we'll remember a time when we, like our children and grandchildren, believed that tadpoles and pollywogs were the most fascinating creatures on the planet! SCW

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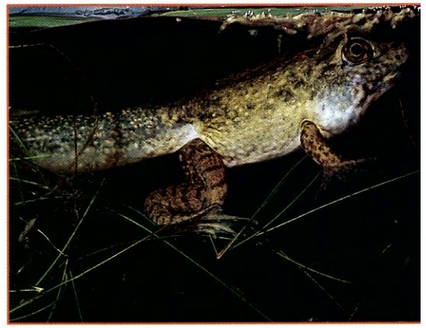

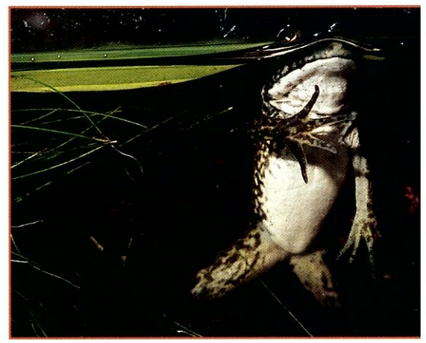

Photos tell the life story, beginning at top left, where the globular egg mass of the bronze frog contrasts with the stringlike eggs of the Southern toad, inset. Newly emerged tadpoles cling to the jellylike spheres of their egg sacs; young tadpoles begin to take on the typical tadpole shape; free-swimming tadpoles feed on bits of algae and detritus. Above, the appearance of hind legs signals the beginning of metamorphosis. With the addition of front legs and the gradual disappearance of the tail, a tadpole begins to look more like a frog. At bottom, a transformed frog floats in the shallow water, waiting to revisit the cycle of life.